

THE MANY ROLES OF AN AUDIOLOGIST IN THE EARLY INTERVENTION OF HEARING LOSS

Capstone Project

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ABSTRACT

Graduate students in audiology have many options to consider when determining the setting in which to work. Audiologists may be employed in government, hospitals, clinics, physician's offices, schools, or early intervention programs. An audiologist working with an early intervention program will have to assume far more roles than are described by the Joint Committee on Infant Hearing 2007 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs. A comprehensive review of the literature was completed to explain that audiologists, when working in early intervention, are advocates, referral sources, audiologic evaluators, relationship builders, counselors, technology gurus and equipment managers, problem solvers, and educators. Balancing each role on a daily basis can lead to an enormously satisfying career for an audiologist when working in early intervention.

DEDICATION

To Christy Goodman...thanks for everything!

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INTRODUCTION

An audiologist, as defined by the *Joint Committee on Infant Hearing (JCIH) Year 2007 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs*, is described as "...a person, who by virtue of academic degree, clinical training, and license to practice, is qualified to provide services related to the prevention of hearing loss and the audiological diagnosis, identification, assessment, and nonmedical and nonsurgical treatment of persons with impairment of auditory and vestibular function, and to the prevention of impairments associated with them" (p. 10). The above definition is incomplete. An audiologist, who specifically works with an early intervention program, has many roles to fulfill above and beyond what the JCIH definition includes. Audiologists are advocates for children with hearing loss, referral sources for families, audiologic evaluators, relationship builders with parents and other members of the community, counselors, technology gurus and equipment managers, problem solvers, educators, and expert communicators.

ROLES OF THE AUDIOLOGIST

Audiologists as Advocates

In 1994, an article entitled, "Universal Screening for Infant Hearing Impairment: Not Simple, Not Risk-Free, Not Necessarily Beneficial, and Not Presently Justified", was published in *Pediatrics* (Bess & Paradise, 1994). The

article described how the recommendation for Universal Newborn Hearing Screening (UNHS) programs, suggested by the National Institutes of Health (NIH) and the National Institute on Deafness and Other Communication Disorders (NIDCD), was not justified at that time. Bess and Paradise (1994) reported that UNHS programs were impractical, ineffective, costly, caused more harm than benefit; they stressed the need for further research before the launch of a nationwide UNHS program. Bess and Paradise (1994) described UNHS programs as impractical due to the fact that newborn babies are discharged from the hospital within twenty-four or forty-eight hours. Therefore, a newborn hearing screening could potentially delay discharge resulting in higher costs and parental stress. Also, Bess and Paradise (1994) estimated that 25% of babies born in the United States are located in rural areas where UNHS programs do not exist; UNHS programs would be ineffective for these babies. In 1994, at the time that the Bess and Paradise study was published, there was not much evidence to support the efficacy of early intervention. Thus, they stated that UNHS programs were ineffective. Bess and Paradise (1994) indicated that excessive cost was associated with UNHS programs. For instance, they reported that the screening programs, assessments, monitoring, intervention, and especially the cost for false-positive testing were too expensive for a program that may not be effective. Bess and Paradise (1994) also described the issue of non-compliance with follow-up after UNHS. They reported that non-compliance was a significant problem then, and would continue to be in the future. It was described that

excessive cost and resources would be needed to minimize the effects of non-compliance (Bess & Paradise, 1994).

On the other hand, research has shown that improved speech, language, and educational outcomes are possible for infants who are deaf or hard-of-hearing when early identification and early intervention services occur (Yoshinaga-Itano, Sedey, Coulter, & Mehl, 1998; Yoshinaga-Itano, 2004).

Attending the NIH and NIDCD Consensus Development Conference on the Early Identification of Hearing Impairment in Infants and Young Children were specialists from many professions, including audiologists. Based on the research outcomes described above, these audiologists advocated for the implementation of a nationwide UNHS program.

According to Yoshinaga-Itano (2004), the early identification of hearing loss is an important component to the speech, language, and educational development of infants with hearing loss; also significant is the provision of early intervention services that occur on the same day as the identification of hearing loss. Yoshinaga-Itano, Sedey, Coulter, and Mehl (1998) conducted a study to evaluate the language skills of children identified with hearing loss before six months of age and after six months of age. The results of that study revealed that children whose hearing losses were identified before six months of age showed considerably better receptive and expressive language skills than those identified after six months of age (Yoshinaga-Itano et al., 1998). This study provides support for the conclusion that early identification of hearing loss will allow for better speech and language outcomes for infants with hearing loss.

Identification, however, is only the first step in the process, as a hearing screening alone will not improve the outcomes for a child who is deaf or hard-of-hearing (Yoshinaga-Itano, 2004).

It was determined by Calderon (1998) that children enrolled in programs early (i.e., before twenty-four months of age) showed improved receptive and expressive language abilities compared to those who were enrolled later (i.e., after twenty-four months of age). Moeller (2000) determined that children who receive intervention services early in life show better verbal reasoning skills and improved vocabulary skills by age five. It is necessary that appropriate early intervention services begin immediately (i.e., on the same day) once a hearing loss has been identified (Yoshinaga-Itano, 2003; Yoshinaga-Itano, 2004). The provision of same day early intervention services may seem impractical; however, counseling the parents about the effects of hearing loss may be a good start. Audiologists associated with early intervention should not only advocate for the establishment of UNHS programs, but also for the immediate provision of early intervention services.

Another opportunity for advocacy is through individualized family service plans (IFSPs). Individualized family service plans are documents created by government institutions, such as early intervention programs, which provide a unique education program for a child with special needs. An IFSP is in place for children from birth to age three years and was created so that children with disabilities would have learning plans tailored to their individual needs. Audiologists associated with early intervention programs are required to

participate in IFSP meetings with parents and other professionals. Their input at these meetings is imperative to the success of deaf or hard-of-hearing children. The *Educational Audiology Association (EAA) Position Statement on the Early Detection and Intervention of Hearing Loss: Roles and Responsibilities for Educational Audiologists* (2002) indicated that audiologists are responsible for providing support to families in the course of development of the IFSP. The role of the audiologist, at an IFSP meeting, is to advocate for infants with hearing loss by ensuring that a reliable audiologic evaluation has occurred, and determining that appropriate amplification has been recommended (Colorado Department of Education Exceptional Student Services, 2004).

Audiologists as Referral Sources

Audiologists associated with the early intervention and identification of hearing loss are responsible for providing referrals to other professionals. Parents of children identified with hearing loss will look to the audiologist for guidance and advice regarding the treatment of their children. An audiologist needs to be able to confidently make referrals to otologists, genetic counselors, other audiologists, early intervention programs, and other support services. The audiologist should have a close working relationship with the professionals to whom they refer to insure that those professionals will provide efficient and quality medical management. An audiologist needs to be comfortable with the referrals made and will also need to know that the referral source will remain in contact regarding diagnoses and treatment of the children they refer.

Audiologists and otolaryngologists (ENTs) should be considered management partners in order for young children with hearing loss to develop speech and language and live productive happy lives (Danhauer et al., 2006b).

Audiologists are often one of the first professionals to examine an infant after a failed newborn hearing screening, and can be considered the child's "medical home" regarding hearing loss. In February 2007, the American Academy of Family Physicians (AAFP), The American Academy of Pediatrics (AAP), the American College of Physicians, (ACP), and the American Osteopathic Association (AOA), collaborated on the *Joint Principles of the Patient-Centered Medical Home*. This statement demonstrates the importance of the "personal physician", in a "physician directed medical practice", focusing on the "whole person", and where "care is coordinated...across all elements of the complex health system" (p. 1). *The Joint Principles of the Patient-Centered Medical Home* (2007) indicated that patients should have an ongoing relationship with a physician who has extensive experience with the pediatric population and who can offer comprehensive and ongoing care. On the other hand, the medical home does not have to be a physician. A 2002 AAP policy indicated that the medical home should include "accessible, continuous, comprehensive, [and] family-centered [care]" (p. 184); these services are certainly available from a proficient audiologist working with an early intervention program. For instance, audiologists are available via telephone or email to answer parent questions or concerns. Also, the audiologist provides services to children on a permanent basis until the child transitions to a school based program, includes all facets of

the child's auditory system in an evaluation, refers to a physician as necessary, and includes the family in all decisions so the best outcomes are available for the child.

Audiologic Evaluators

As previously stated, an audiologist is a professional who diagnoses, treats, and manages persons with impaired auditory function (American Academy of Audiology [AAA], 2008). The basic diagnostic procedure should include a thorough case history (Windmill & Windmill, 2006) and evaluation of the integrity of the auditory system (i.e. outer ear, middle ear, inner ear, and auditory pathways). Audiologists are trained to assess the hearing acuity of patients of all ages and abilities. At times, flexibility is required to successfully complete the assessment, especially for young children.

When performing audiologic evaluation on infants and children, age needs to be considered. Audiologists should know how to modify testing to accommodate children depending on their age. Due to the development of UNHS programs, very young children are being referred for full diagnostic audiologic evaluations. Behavioral threshold measurements are considered the gold standard for evaluating hearing loss, but are often the most difficult to obtain in very young children who cannot respond behaviorally (Widen et al., 2005). Electrophysiologic measures, such as the auditory brainstem response (ABR) and otoacoustic emissions (OAEs), will provide physiological information regarding the status of the auditory system. Assumptions about hearing

sensitivity can be based on these measures; however behavioral threshold measures should be obtained as soon as possible to validate the results of the ABR or OAEs (Widen et al., 2005). Both objective and subjective test methods should be used as cross-checks to identify hearing loss in a young child (Widen et al., 2005).

An audiologist associated with early intervention and identification of hearing loss will receive referrals for a comprehensive diagnostic evaluation after a newborn baby fails a hearing screening at the hospital. The diagnostic audiologic evaluation is a vital component to successful outcomes of children who are deaf or hard-of-hearing (Windmill & Windmill, 2006). Again, the behavioral audiology assessment, used to measure hearing sensitivity depends on the age of the child. Visual reinforcement audiometry (VRA) is used to test children from age five to six months to approximately three years (Diefendorf, 2002), and uses a head turn in response to a sound that is rewarded with a light up toy. Conditioned Play Audiometry (CPA) is used to test children between the ages of three and five years (Diefendorf, 2002) and makes a game out of listening for puretones; children are instructed to drop a block or place a peg when they hear the stimulus tone. As an audiologist who diagnoses hearing loss in young children, flexibility comes from the techniques used to test infants, and knowledge and experience with each diagnostic procedure is essential.

Audiologists as Relationship Builders

Screening for hearing loss shortly after birth (i.e., UNHS) is only the first part of the identification and intervention process (Spivak & Sokol, 2005).

Universal newborn hearing screening programs will provide no benefit to deaf or hard-of-hearing children without follow-up (Spivak & Sokol, 2005). If children are identified with hearing loss at an early age, but do not receive early intervention services to remediate the effects of the hearing loss, there is no reason for UNHS programs to exist.

If an infant is identified as “at-risk” for hearing loss, and no follow-up occurs, the UNHS and early hearing detection and intervention (EHDI) programs have failed. Without follow-up to the early identification of hearing loss, children with hearing loss will grow and develop similar to a child with an unidentified hearing loss. Speech and language will not develop typically, and without intervention, children will struggle with academic (Windmill & Windmill, 2006) and social-emotional development (Yoshinaga-Itano, et al., 1998). According to the Directors of Speech and Hearing Programs of State Health and Welfare Agencies (DSHPSHWA) Data Summary: Reporting Year 2003, 44.8% of infants were “lost to [the] system” before the presence of a hearing loss could be identified (Directors of Speech and Hearing Programs of State Health and Welfare Agencies [DSHPSHWA], 2005, p. 1).

The success of UNHS programs and follow-up care is dependent on an interdisciplinary team approach. The team should include audiologists, physicians (i.e., pediatricians and otolaryngologists), hospital staff (i.e., nurses and social workers), and parents (Danhauer et al., 2006a). Yoshinaga-Itano (2004) and Widen et al. (2005) stated the vital importance of physicians to newborn hearing screening program success. Infants who do not pass a hearing

screening at birth are referred by the UNHS audiologist for a complete diagnostic audiologic evaluation. The diagnostic evaluation should include an extensive case history, otoscopic examination, and electrophysiologic and behavioral measures of hearing acuity. The pediatric audiologist may refer an infant to their primary care physician (pediatrician) or a pediatric otolaryngologist (ped-ENT) for medical evaluation of the auditory system (Boone, Bower, & Martin, 2004).

Families of infants with hearing loss may not be able to take advantage of the benefits of early identification if ENTs do not stress the importance of continuous and timely audiologic follow-up (Danhauer et al., 2006a). Primary care physicians have an important responsibility in explaining to families the importance of following up on the referral from newborn hearing screening (Widen et al., 2005). To meet the goals for EHDIPs set forth by the JCIH, ENTs and pediatricians need to understand the importance of encouraging parents to seek audiology services once medical intervention has occurred (Danhauer et al., 2006a). Also, once ENTs and pediatricians medically treat these infants, they should encourage parents to comply with the recommendations for follow-up made by audiologists (Danhauer et al., 2006a). It was stated that "...we cannot emphasize enough the invaluable role that ped-ENTs play in encouraging families to comply with professionals' recommendations for their babies. These findings also show the need for having open lines of communication, establishing the roles of the stakeholders and participants in NHSPs [newborn hearing screening programs], and sharing responsibilities and information among members of the team" (Danhauer et al., 2006b, p. 715).

According to Danhauer et al. (2006a), audiologists can prevent infants from being lost to follow-up by establishing strong relationships with ENTs and pediatricians and by educating them on the importance of EHDIPs. In a study completed by Danhauer et al. (2006b), a survey was distributed to pediatric ENTs across the country to examine their attitudes and knowledge toward early hearing detection and intervention programs. The results indicated that 15.2% of the respondents were not familiar with the 2000 JCIH Position Statement (Danhauer et al., 2006b). Also, many of the respondents incorrectly answered questions regarding the 1-3-6 benchmarks set forth by the document. Interestingly, 98.4% of the pediatric ENTs that participated in the survey indicated that they diagnosed and treated infants referred from UNHS programs (Danhauer et al., 2006b). The overall outcomes determined from the research study revealed that there is a dire need for pediatric ENTs to be further educated on UNHS programs and their goals (Danhauer et al., 2006b). Audiologists should build strong relationships in their communities by organizing informational sessions for the public, creating an electronic newsletter for physicians, offering free hearing screenings, and making direct and continual contact with physicians

Two further findings were reported by Danhauer et al. (2006b). First, pediatric ENTs do not perceive themselves as an integral part of the EHDIPs. This is another area where strong relationships between audiologists and ENTs could change this erroneous point of view. For example, one-on-one meetings with physicians will establish open lines of communication and develop good working relationships where the importance of the physician to EHDIPs should be

emphasized. The second finding from this study revealed that 78% of the ENTs who responded were interested in receiving additional information about EHDIPs (Danhauer et al., 2006b). Thus, another area in which audiologists can foster strong relationships with ENTs is providing correct information in a timely manner about EHDIPs in formats (i.e., emails, websites) easily viewed by these physicians (Danhauer et al., 2006b). The information should include the correct benchmarks recommended by the JCIH Position Statement, the importance of follow-up for speech and language and literacy development, and the important and influential relationships between pediatric ENTs and parents.

Audiologists as Counselors

The scope of practice for an audiologist includes the provision of counseling on the psychosocial aspects of hearing loss (American Speech-Language-Hearing Association [ASHA], 2004). Audiologists associated with EHDIPs spend a significant portion of their day counseling parents and other professionals. This role is significant for an audiologist, and should not be taken lightly. According to Yoshinaga-Itano (2004) "...counseling may play [an important role] in improved speech, language, or education development" (p. 454). Audiologists are required to inform parents of their child's hearing loss, counsel them on the impact of hearing loss, and stress the importance of follow-up; how they convey the information can have a significant impact on the outcomes for the child.

English (2004) presents guidelines for informing parents of their child's hearing loss. First, it was recommended that the audiologist, or professional who

will plan the treatment, convey the information about the presence of a hearing loss. Next, it was recommended that the information be told in a simple and straightforward way, in a private setting without interruptions. Third, the parents should be permitted to ask any questions they may have to ensure they understand the circumstances. It was stated that parents' initial questions represent what is foremost on their minds and should be addressed first (English, 2004). Next, parents should be encouraged to express any feelings they may be having at that time, or at future appointments. Often, parents that are in denial or shock may not obtain services for their children in a timely manner due to their own negative feelings toward the situation. In order to insure the emotional needs of the parents are met, they should be approached with understanding and a positive attitude. Although the need for immediate intervention is at the forefront of an audiologist's thought processes, English (2004) recommends allowing the parents time for action and decision making. Upon discovering their child's hearing impairment, parents need time to accept the diagnosis of the hearing loss, before making any major treatment decisions. When the hearing loss is first identified and the parents are first told, English recommended making sure the parents know that important medical decisions need to be made now, or in the near future. The article also recommended that the audiologist offer other services to the parents, such as contacts to other physicians associated with the family or parents of children with hearing loss. Next, the parents need concrete activities to keep them busy before their next appointment, such as written materials, videos, and websites about children with hearing loss (English, 2004).

If requested by the parents, informational books such as *My Baby and Me* written by Betsy Moog Brooks, and websites such as The Alexander Graham Bell Association for the Deaf and Hard of Hearing at www.agbell.org, should be provided by the audiologist. Also, parents could benefit from an audiogram with the “speech banana” that indicates where speech sounds are located compared to their child’s hearing loss or a hearing notebook where parents can write notes about the auditory behaviors of their child. The notebook can also be used for questions the parents may have. The final steps include making a follow-up appointment in a timely manner where other family members or friends are encouraged to attend for support or to answer questions they may have. At that follow-up, the audiologist should review the information from the last appointment and answer any further questions or concerns raised by the parent. The final guideline recommends tracking all information conveyed and discussed at each appointment.

Counseling plays a significant role for the profession of audiology, therefore audiologists need to be aware of how the information they convey is processed. Parents who understand fully and accurately all information given to them have less anxiety, shorter time to obtain treatment, and lower treatment costs overall because they understand the process and can make appropriate decisions for successful outcomes (Margolis, 2004). Only 50% of information presented by healthcare professionals to parents is retained, and 40-80% is forgotten immediately (Margolis, 2004). Also, approximately half of the retained information is remembered incorrectly (Margolis, 2004). The findings from

Margolis (2004) suggest that follow-up appointments are essential for not only discussing treatment options, but for clarifying information, discussing thoughts and questions from the hearing notebook (English, 2004) and providing additional information as well.

Margolis (2004) suggested that there are several factors that affect the recall of information which is important for successful treatment and outcomes. He indicated that patient factors, mode of presentation, and clinician factors exist. When considering patient factors, patients more easily remember information that is familiar, expected, and welcomed or desired (Margolis, 2004). Also, elderly, severely anxious, and stressed patients tend to retain less information (Margolis, 2004). Finally, patients that are in denial will not remember all information presented and will not relay accurate information to their families (Margolis, 2004). The mode of presentation is also important when presenting information to parents. Complex information is forgotten more quickly than simple, easy-to-understand information, more information is remembered when less is presented initially, and the data that is presented first is more easily remembered (Margolis, 2004). Also, supplementing words with written or audio-visual information can be helpful (Margolis, 2004). And, specific, rather than general, recommendations are more often followed by the family.

Clinician factors include communication style, anxiety level of the clinician, and perceived importance of the information (Margolis, 2004). Relaying information that is clear and concise is more effective; misleading information can confuse parents and cause the delay of intervention (American Speech-

Language-Hearing Association [ASHA], 2008). An audiologist that appears nervous will provide information that is not recalled by parents (Margolis, 2004). If the importance of the information is stressed, and the information is presented in an organized, clear, and complete manner, accurate recall should occur (Margolis, 2004). Any information that is important to the parents should be provided in writing to insure recall and comprehension (Margolis, 2004).

According to the *Guidelines for Audiologists Providing Informational and Adjustment Counseling to Families of Infants and Young Children with Hearing Loss Birth to 5 Years of Age* (ASHA, 2008), both informational and adjustment counseling are prevalent in the life of an audiologist. Informational counseling is described as the provision of information to parents about audiograms, technology, communication mode, educational placement, and advocacy (ASHA, 2008). Adjustment counseling is described as the support provided by audiologists to families as they cope with their child's hearing loss (ASHA, 2008). Audiologists associated with early intervention programs should be prepared to offer a balanced amount of both types of counseling throughout the process of early identification and intervention (ASHA, 2008).

Audiologists are also responsible for counseling parents and children about the prevention of hearing loss (ASHA, 2004). Noisy equipment (i.e., power tools and lawnmowers), harmful levels of noise, and hearing protection devices should all be discussed with parents and children. Often times, children's toys are very noisy and can cause damage to a child's hearing. An estimated 5.2 million children in the United States between ages six through nineteen years are

thought to show noise-induced hearing shifts in one or both of their ears (Niskar, Kieszak, Holmes, Esteban, Rubin, & Brody, 2001). The Sight and Hearing Association (SHA) exists to examine the noise level of a variety of toys (Sylvester, 2006). In an article published in 2006, it was stated that 50% of toys tested by the SHA produced sounds that were louder than 100 dB (Sylvester, 2006). Because sound levels above 90 dB can permanently damage hearing in a short span of time, these toys can ultimately cause permanent hearing damage (Sylvester, 2006). Young children need to be educated about the importance of their hearing. Audiologists associated with early intervention programs should consider counseling parents on noise exposure an important part of their job. According to a study by Luterman and Kurtzer-White (1999), the parents of children identified with hearing loss want to hear the diagnosis directly from the audiologist. In essence, this means that audiologists need to be skilled clinicians and “empathetic [and] supportive counselor[s]” (Luterman & Kurtzer-White, 1999, p. 4).

Audiologists as Technology Gurus and Equipment Managers

Due to the early identification and intervention of hearing loss, young children are being fit with hearing technology (i.e., amplification) within the first few months of life. One of the most important responsibilities of a pediatric audiologist is the timely fitting of appropriate amplification for infants and children who are deaf or hard-of-hearing (The Pediatric Working Group, 1996). The term “appropriate amplification” refers to technology that is appropriate for a particular hearing loss, but should also refer to technology that is up to date with the

current trends in amplification that are appropriate for children. It is of utmost importance for an early intervention audiologist to remain apprised of advances in technology so that he or she can apply those advances to young children with hearing loss.

Technology is continuously progressing, making it necessary for audiologists to constantly be aware of the advances in hearing aids and other assistive devices (Abrams, Edwards, Eiler, Olson, & Woods, 2007). The Ohio Board of Speech Language Pathology and Audiology requires that licensed audiologists obtain twenty hours of continuing education credits over a two year time period. For an audiologist working in early intervention, these continuing education hours should be primarily focused on the ever-changing technology available in hearing aids, cochlear implants, FM systems, and diagnostic equipment.

Hearing aids are electroacoustic devices designed to provide amplification to a hard-of hearing person based on a particular hearing loss. Hearing aids will provide "...an audible signal for the development and maintenance of aural/oral communication for formal and informal learning..." (The Pediatric Working Group, 1996). A frequency-modulated (FM) system is a type of assistive listening device designed to improve the signal-to-noise ratio for a person with hearing loss. Signal-to-noise ratio is defined as the comparison of the overall volume of a signal (speech) with the overall volume of background noise (Crandell & Smaldino, 2004). A favorable signal-to-noise ratio (i.e., when speech is louder than background noise) makes speech easier to understand for a person with

hearing loss. FM systems work to bring the voice of the speaker directly into the ear of the hearing impaired user, while compensating for the effects of distance from the speaker, reverberation, and background noise.

Over the next twenty-five years, the proportion of the population with hearing loss will almost double (Abrams et al., 2007). Not only will older adults require audiology services, but so will younger adults who have grown up in a technologically advanced world. This new technologically advanced patient population will expect to have access to an audiologist who is “technologically sophisticated” (Abrams et al., 2007), and will settle for no less. Children born in 2008 are entering into a technology-filled world. As they age, they will be more technologically advanced than any other previous generation. When these children are identified with hearing loss, technology will certainly play a part in the amplification and other equipment options available to them.

It is in the scope of practice for an early intervention audiologist to recommend and fit amplification for children with hearing loss. The hearing aid options available today are exciting and technologically advanced. Automatic and adaptive directional microphones and adaptive feedback cancellation systems are two of the features available today that make hearing aids beneficial for children with hearing loss. According to Kuk and Marcoux (2002), adaptive directionality provides a reliable signal-to-noise ratio enhancement independent from the location of the noise when compared to fixed directionality. Automatic and adaptive directionality will provide amplification to sounds coming from all directions allowing for incidental learning and speech and language

development. Because infants and young children are constantly outgrowing earmolds, feedback may occur. Their hearing aids should implement an adaptive feedback management system to allow for the audibility of all sounds without the interference and distraction of feedback (Kuk & Marcoux, 2002). Since the advanced digital technology hearing aids recommended for infants and young children are automatic and adaptive, audiologists, parents, and teachers do not need to worry about hard-of-hearing children lacking amplification where it is needed most.

It is also necessary for an early intervention audiologist to recommend hearing aids that are flexible, durable, and appropriate for all the child's environments. Binaural behind-the-ear hearing aid fittings are the most appropriate option for infants and young children (AAA, 2003). First, they are durable and flexible and will last approximately five years while only the earmolds need to be replaced when growth occurs. Also, behind-the-ear hearing aids couple easily with FM systems which will significantly benefit the child during the school age years by improving the signal-to-noise ratio and reducing the effects of distance from the speaker, reverberation, and background noise.

Cost certainly needs to be taken into consideration, however, should not be the only deciding factor when recommending hearing aids. The Ohio Department of Health houses the Bureau for Children with Medical Handicaps (BCMH). This organization exists to provide supportive services to children age birth through twenty-one and their families. An audiologist working in early intervention should be familiar with the local services and organizations available

for infants and young children identified with hearing loss, and should feel comfortable referring families for these services.

Since the Food and Drug Administration (FDA) first approved cochlear implants for use in the United States in 1984 (Kluwin & Stewart, 2000) their use has been increasing significantly. The current candidacy for cochlear implantation for children has changed since 1984 due to technological advances. Now, children must be at least twelve months of age with hearing loss greater than ninety decibels in both ears to be a cochlear implant candidate (Advanced Bionics, LLC, n.d). Also, a psychologist will evaluate the child and his or her family and determine if they have strong family support and appropriate expectations and motivations for cochlear implantation (Advanced Bionics, LLC, 2008). Cochlear implant teams may consider parent involvement a requirement for cochlear implant eligibility (Geers & Brenner, 2003).

Evidence has shown that there are many benefits to cochlear implantation. According to Geers, Brenner, and Davidson (2003), cochlear implantation before age five provides improvements in auditory speech perception abilities. Also, children with average cognition, when implanted before age five, have the ability to produce and understand English language at the same level as their hearing peers (Geers, Nicholas, & Sedey, 2003). Profoundly deaf children, who receive cochlear implants by age five, are more competent, happy, and well-adjusted than deaf children without implants because they are able to successfully communicate with members of their family in their native language (Nicholas & Geers, 2003). Finally, research has shown

that children implanted by age five show improved spoken language competence and social interactions, which, in turn, allow for better jobs and improved quality of life (Moog & Geers, 2003).

Research has shown that the most important time for auditory development is during first two years of life (Geers, Brenner, & Davidson, 2003). Age at implantation is a common topic among parents of children newly identified with hearing loss. An audiologist working in an early intervention program should be able to address parent questions and concerns regarding the age of implantation.

In 2000, the FDA changed the candidacy criteria for cochlear implantation from eighteen months to twelve months of age (Geers, 2004). Due to universal newborn hearing screening programs, young children are ideally identified with hearing loss by three months of age, with intervention in place by six months of age (Joint Committee on Infant Hearing [JCIH], 2007). Audiologists engaged in early intervention should be knowledgeable about the benefits of cochlear implantation before most of the prime auditory development time is lost (i.e., before age two). According to Geers (2004), when children experience only a short auditory deprivation time period during the critical language learning years, normal speech and language development is possible through the use of a cochlear implant.

Kluwin and Stewart (2000) reported that parents who opt for a cochlear implant do so in order for their child to live life in a hearing world. In other words, parents want their children to develop spoken language (Kluwin & Stewart,

2000), understand speech, and be able to participate socially in family and worldly events (Moog & Geers, 2003). Academically, parents want their children to be educated in a mainstream classroom. According to Moog and Geers (2003), speech intelligibility and reading ability were important considerations for whether or not a child could be educated in a mainstream classroom. In a study by Geers (2003), more than half of the children who received cochlear implants before age five demonstrated reading scores within the average range for same age children with normal hearing abilities. In turn, children with better reading abilities are more often placed in mainstream classrooms (Geers, 2003). This fact, coupled with improved speech production and comprehension abilities, should allow for profoundly hearing impaired children to be educated in as normal a setting as possible (Moog & Geers, 2003).

The benefits of cochlear implants, including the development of speech and language and improved reading abilities, are available to young children with severe to profound hearing loss that were not possible when hearing aids were the only option. In the past, children who were candidates for cochlear implantation had profound hearing loss in both ears but only received one cochlear implant. Although the benefits of cochlear implantation still existed with only one implant, the advantages to binaural hearing were lost. The benefits of binaural hearing include binaural summation, the head shadow effect, the squelch effect, and sound localization (Bess & Tharpe, 1986). According to the *William House Cochlear Implant Position Statement on Bilateral Cochlear Implantation* patients with unilateral cochlear implants reported difficulty with

sound localization and speech intelligibility in noisy conditions (Balkany et al., 2008). Due to the importance of bilateral hearing for speech intelligibility and sound localization, the *William House Cochlear Implant Position Statement on Bilateral Cochlear Implantation* “strongly endorses” bilateral cochlear implants for adults and children (Balkany et al., 2008, p. 107). Although there are certain advocates for bilateral cochlear implantation, there is limited evidence to support the benefits at this time, there has been, however, a trend in that direction. Audiologists working with early intervention programs should be knowledgeable about the benefits of binaural amplification or cochlear implantation and should be able to provide this information to parents.

Bimodal amplification is another option for profoundly hearing-impaired children. Bimodal amplification refers to the situation in which a cochlear implant is used on one ear and a hearing aid is used on the opposite ear. This amplification strategy provides some of the benefits of binaural hearing to a deaf or hard-of-hearing child. Schafer, Amlani, Seibold, and Shattuck (2007) analyzed 16 research studies where bilateral cochlear implants and bimodal amplification were compared in the presence of background noise. The results revealed that patients implementing bilateral cochlear implants or bimodal amplification understood speech in noise better than those with a monaural hearing aid or cochlear implant. These results indicate that when dealing with a bilateral hearing loss in children, binaural amplification (i.e., two hearing aids, two cochlear implants, or bimodal stimulation) is beneficial for speech understanding in noise. An audiologist associated with early intervention should remain up-to-

date on the advances made in binaural hearing, bimodal amplification, cochlear implants, and hearing aids, and should be able to provide that information to parents of deaf or hard-of-hearing children.

Audiologists in early intervention and identification programs need to be organized and efficient equipment managers. Hearing aids, transmitters, FM receivers, and cochlear implants all have serial numbers that need to be tracked in an organized manner. Often times, demonstration hearing aids will be made available for parents of newly identified children. Demonstration hearing aids need to be closely tracked to be sure they are returned in a timely manner.

Hearing aids, especially those on children, can easily be broken and are often in need of repair. Assistive listening devices and hearing aids sent to the manufacturer for repair need to be tracked to be sure they are returned and fit on the correct child. Also, loaner hearing aids given to children to use while theirs are being repaired need to be tracked. Hearing aids that return from repair should be programmed correctly, exchanged for any loaner hearing aids given, and fit on the child as soon as possible

Audiologists as Problem Solvers

Audiologists associated with early intervention often act as problem solvers. They are called upon to determine the appropriate solution for many different types of issues. For example, hearing aids and cochlear implants need to connect to other types of technology, including FM systems. Because not all hearing aids can accommodate FM technology, and not all hearing aids connect

to FM immediately upon connecting a receiver, audiologists need to know which ones will work. Only hearing aids that can be connected to FM via an audio shoe and receiver should be recommended for school age children. Also, for hearing aids that do not immediately connect in the presence of a receiver, the software should be programmed at the time of the fitting to avoid any delays in the future.

Due to the success of early identification and intervention of hearing loss programs, very young children are identified with hearing loss and fit with hearing aids. At times, the hearing aids are larger than the ears themselves and the audiologist needs to “problem solve” to get the hearing aids to stay in place. Also, children with head and facial deformities may have hearing loss. It is the challenging job of the audiologist to determine the best method for keeping the hearing aids on underdeveloped or deformed ears.

Audiologists working in early intervention programs also act as problem solvers to determine if a hearing aid or FM system is functioning properly. Visual inspections, listening checks, and electroacoustic analysis are tools available to audiologists when a hearing aid may be malfunctioning. Visual inspection and troubleshooting are used often to evaluate the integrity of an FM system that is working intermittently. Parents, teachers, and young children themselves will often need an audiologist to solve their earmold, hearing aid, and FM system problems.

Educators

On a daily basis, audiologists act as educators. They provide information to physicians, parents, legislators, and members of the community. Educating people, in general, is one of the most important roles an audiologist plays. When consulting with physicians, both ENTs and pediatricians or other primary care doctors, audiologists need to convey many different pieces of information. First, they need to discuss, in detail, the importance of UNHS programs; they also need to convey the importance of follow-up (Danhauer et al., 2006b). Parents who do not follow-up with an audiology referral will more than likely take their baby to his or her well baby check-ups. During these appointments, physicians have the ability to convince parents that they should proceed with the follow-up hearing evaluation. The important role that physicians play in the UNHS and early intervention process cannot be stressed enough.

When discussing hearing loss with parents, much information needs to be included. Ninety percent of profoundly deaf babies are born to hearing parents (National Institute on Deafness and Other Communication Disorders, 2000), therefore hearing loss, especially infant hearing loss, may be new to parents and they may need information and guidance. Fewer children are lost to follow-up when education about UNHS programs is successful (Danhauer et al., 2006b). Parents should be encouraged to continually monitor developmental milestones in the areas of speech and language development since passing a UNHS does not mean a baby will have normal hearing for life (See Appendix A). It should be explained that hearing loss is invisible, and that even very caring parents may be

fooled by their visually aware children (Yoshinaga-Itano, 2004). Parents should be made to understand the importance of audiological follow-up. They should be told that children with hearing loss alone, if discovered early, and treated appropriately, can develop normal speech and language skills (Yoshinaga-Itano, 2004). The UNHS is essentially a snapshot in time (Danhauer et al., 2006b) and will miss progressive or late-onset hearing losses (Widen et al., 2005).

The parents of a child newly identified with hearing loss have important decisions to make in a short period of time so that the critical time for language development is not lost (Geers, Brenner, & Davidson, 2003). The preferred mode of communication for the child and family is one of the first things the parents will have to consider after confirmation of a hearing loss.

Communication mode is described as the method by which the family and child exchange language (Gravel & O’Gara, 2003; see Appendix B). According to Gravel and O’Gara (2003), early intervention that is language-based will result in greater expressive and receptive language skills regardless of communication mode. The audiologist associated with early intervention is required to explain the different modes of communication to parents in an unbiased and professional manner (ASHA, 2008). Further, the audiologist should explain to parents that language and development of communication need to be stimulated and that a permanent mode of communication can be determined in time.

Audiologists as Expert Communicators

Audiologists associated with early intervention programs have the very important role of expert communicator. Audiologists involved in early intervention need to accurately and effectively communicate many important pieces of information to parents of children newly identified with hearing loss. They need to know what to say, but more importantly, how to say it. Audiologists need to speak slowly and clearly, so that the information they are conveying is understandable (Tye-Murray, 2004). Pronunciation, voice quality, and volume of speech are all facets of the audiologist's communication skills that should be considered and consciously monitored for acuity. Audiologists involved in early intervention are the highest authority for the management of infants and young children with hearing loss; they will not be taken seriously if their communication abilities are poor.

According to the American Academy of Pediatrics (2004), pediatric patient populations are increasing in cultural diversity. Cultural attributes such as race, ethnicity, religion, and language, will change so that patient populations can vary in many ways. Audiologists acting as expert communicators need to be aware of these cultural differences, especially in language, and be prepared to address them. The use of translators or interpreters during audiologic assessment and management is essential to an audiologist working with early intervention programs (ASHA, 2008). Due to the cultural and linguistic barriers that may occur when children and their parents are non-native speakers of English, the use of interpreters can help insure that accurate communication occurs (AHSA,

2008). Accurate communication will allow for comprehensive audiologic care and appropriate follow-up treatment (AHSA, 2008).

Knowledge of American Sign Language (ASL) may be a useful skill for an audiologist engaged in early intervention services. Some parents may choose total communication (TC) or Bilingual-Bicultural (Bi-Bi) education for their children (See Appendix B). In these cases, the children on the audiologist's caseload could possibly depend on sign language for communication, even if only for the first few years of life. According to Magnusen (2000), parents of profoundly deaf children should begin to stimulate language by signing with their child. Sign language has *not* been shown to prevent spoken language, and should be used for early communication even if cochlear amplification is expected in the future (Magnusen, 2000). For an audiologist in an early intervention program, the knowledge of ASL may be beneficial for communicating and developing relationships with children young children and their families.

CONCLUSIONS

The definition of an audiologist encompasses significantly more than the JCIH (2007) describes, particularly for those involved in early identification and intervention of hearing loss. In fact, an audiologist who works with an early intervention program fulfills many roles, including that of an advocate, referral source, audiologic evaluator, relationship builder, counselor, technology guru and equipment manager, problem solver, educator, and expert communicator. All of these roles allow the audiologist to have an incredibly valuable impact on the

developmental and educational future of the hearing-impaired child. This, in turn, can result in an immensely rewarding career for the audiologist. In conclusion, an audiologist associated with an early intervention program successfully balances all of the above roles during every working day, while maintaining a high level of expertise and professionalism.

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APPENDIX A

Speech and Language Developmental Milestones

Birth to 5 Months

Reacts to loud sounds
Turns head toward sound source
Watches faces when talked to
Vocalizes pleasure and displeasure (laughs, cries, fusses)
Makes noise when talked to

Age 6 -11 months

Understands “no”
Babbles (“ma ma ma”
Tries to communicate using actions or gestures
Tries to repeat sounds

Age 12-17 months

Attends to a book or toy for about 2 minutes
Follows simple directions accompanied by gestures
Answers simple questions nonverbally
Says 2 – 3 words to label a person or object
Tries to imitate simple words

Age 18-23 months

Enjoys being read to
Follows simple commands without gestures
Points to body parts, such as “nose”
Understands simple verbs, such as “eat”
Correctly pronounces most vowels
Begins to use other speech sounds
Says 8-10 words
Asks for common foods by name
Makes animal sounds, such as “moo”
Starting to combine words, such as “more milk”
Begins to use pronouns, such as “mine”

Age 2-3 years

Knows about 50 words
Knows some spatial concepts, such as “in” or “on”
Knows pronouns, such as “you” and “me”
Knows descriptive words, such as “big” and “happy”
Says approximately 40 words
Speech is becoming more accurate, but strangers may have difficulty understanding
Answers simple questions

Begins to use more pronouns, such as “you” or “I”
Speaks in 2 to 3 word phrases
Uses question inflection to ask for something
Begins to use plurals and regular past tense verbs

Age 3-4 years

Groups objects such as food and clothes
Identifies colors
Uses most speech sounds but may distort some that are more difficult
Uses consonants in the beginning, middle, and ends of words
Strangers are able to understand much of what is said
Able to describe the use of objects such as “fork” or “car”
Has fun with language; enjoys poems
Expresses ideas and feelings rather than just talking about the world around him or her
Uses verbs that end in “ing”, such as “walking”
Answers simple questions such as “what do you do when you are hungry?”
Repeats sentences

Age 4-5 years

Understands spatial concepts such as “behind” and “next to”
Understands complex questions
Speech is understandable but makes mistakes pronouncing complex words
Says about 200-300 different words
Uses some irregular past tense verbs such as “ran” or “fell”
Describes how to do things such as painting a picture
Defines words
Lists items that belong in a category, such as animals or vehicles
Answers “why” questions

Age 5

Understands more than 2000 words
Understands time sequences
Carries out a series of 3 directions
Understands rhyming
Engages in conversation
Sentences can be 8 or more words in length
Uses compound and complex sentences
Describes objects

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APPENDIX B

COMMUNICATION OPTIONS AVAILABLE FOR UE BY CHILDREN WITH HEARING LOSS

Option/Features	Familial Role	Amplification
Auditory-Verbal <ul style="list-style-type: none"> Maximizes use of residual hearing to develop spoken language <ul style="list-style-type: none"> Auditory channel is primary input mode: exclusively during language learning experiences/therapeutic intervention. Restricts use of visual cues, speech reading and signs Provides only auditory training 	<ul style="list-style-type: none"> Serve as spoken language models Provide abundant opportunities for spoken language learning through Auditory-Verbal techniques in the home environment Seek professionals support from those knowledgeable in AV approach Ensure appropriate audiologic management Monitor rigorously the performance of amplification/cochlear implant technology Desire mainstream educational setting & inclusion in hearing community as primary goal 	<ul style="list-style-type: none"> Provide early amplification Provide maximum audibility across the speech-frequency range Promote consistent use of hearing aids, FM systems and/or Cochlear Implant
Auditory-Oral <ul style="list-style-type: none"> Maximizes use of residual hearing and speech reading to develop spoken language <ul style="list-style-type: none"> Use of both auditory and speech reading encouraged during language learning and therapeutic experiences Provides both auditory and speech reading training 	<ul style="list-style-type: none"> Serve as spoken language models Provide abundant opportunities for spoken language learning using auditory and speech reading input in the home environment Arrange for appropriate Auditory-Oral programs/professionals Ensure appropriate audiologic management Monitor rigorously the performance of amplification/cochlear implant technology Desire mainstream educational setting & inclusion in hearing community as primary goal 	<ul style="list-style-type: none"> Provide early amplification Provide maximum audibility across the speech-frequency range Promote consistent use of hearing aids, FM systems and/or Cochlear Implant
Cued Speech <ul style="list-style-type: none"> Makes spoken language visible through use of specific handshapes, positions and lipreading (i.e., cues) 	<ul style="list-style-type: none"> Learn and become fluent in Cued Speech Provide abundant opportunities for spoken language learning cueing all communication interactions with the child in the home environment Support use of Cued Speech by early intervention personnel, teachers and all others communicating regularly with child Arrange for appropriate educational settings or Cued Speech transliterator Determine desire for child to use amplification or cochlear implant technology 	<ul style="list-style-type: none"> Amplification not necessary for spoken language acquisition Provide maximum audibility across the speech-frequency range when family desires child to use amplification or cochlear implant
Manually Coded English (MCE) <ul style="list-style-type: none"> Uses sign system and fingerspelling to represent spoken English Often used in conjunction with Total Communication and Simultaneous Communication 	<ul style="list-style-type: none"> Learn and become fluent in manual sign system (MCE) Arrange for appropriate educational settings/professionals who are fluent users of MCE system used by the child or interpreter 	<ul style="list-style-type: none"> Amplification not necessary Provide maximum audibility across the speech-frequency range when family desires child to use amplification or cochlear implant
Total Communication <ul style="list-style-type: none"> Uses multiple methods simultaneously (manual, oral, auditory) Uses MCE system 	<ul style="list-style-type: none"> Learn and become fluent in manual sign system (MCE) Encourage speech reading and use of audition in combination with sign (MCE) Arrange for appropriate educational setting/TC professionals who are fluent in TC and support use of sign, speech reading and audition Ensure appropriate audiologic management 	<ul style="list-style-type: none"> Provide amplification early amplification Provide maximum audibility across the speech-frequency range Promote consistent use of hearing aids, FM systems and/or Cochlear Implant
Simultaneous Communication <ul style="list-style-type: none"> Use sign system and finger spelling and speech Does not require use of audition 	<ul style="list-style-type: none"> Learn and become fluent in manual sign system (MCE) Encourage speech and sign (MCE) Arrange for appropriate educational setting; may be the same as TC (as above) Ensure appropriate audiologic management when required 	<ul style="list-style-type: none"> Amplification not generally used for communication as part of approach
American Sign Language (ASL) <ul style="list-style-type: none"> Native language of the American Deaf community Complete visual language distinctly different from English Incorporates signs, body language, facial expression, movement 	<ul style="list-style-type: none"> Learn and become fluent in ASL Ensure regular interaction with members of Deaf culture/community Provide opportunities for child interaction with peer group that uses ASL Arrange for appropriate ASL educational setting/ASL interpreter 	<ul style="list-style-type: none"> Amplification not used for visual language learning Amplification/CI may be used for alerting, warning, awareness of environmental sounds
Bilingual-Bicultural (Bi-Bi) <ul style="list-style-type: none"> Philosophy of language learning: first ASL, second spoken language (e.g., English) Combines ASL and form of spoken language (MCE, Cued Speech) Opportunities for experiences in Deaf and hearing communities 	<ul style="list-style-type: none"> Learn and become fluent in ASL Ensure regular interaction with members of Deaf and hearing culture/community Arrange for appropriate educational setting in program supporting Bi-Bi philosophy 	<ul style="list-style-type: none"> Amplification not required for visual language learning Amplification/CI may be used for alerting, warning, awareness of environmental sounds and for support of spoken language development

Gravel, J. S., & O'Gara, J. (2003). Communication Options for Children with Hearing Loss. *Mental Retardation and Developmental Disabilities Research Reviews*, 9, 243-251.